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Dr. R.W. Hellwarth

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FIELD	GROUP	SUB-GROUP	Optical beam phase conjugation, Picosecond optical pulses, Optical polymers, Photorefractive materials.
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19. ABSTRACT (Continue on reverse if necessary and identify by block number)
With this equipment grant we have established and instrumented an optical laser source at 1.06 microns and three harmonics, with the added capability of a tunable dye laser pumped at any of these harmonics. Pulse lengths are available from 10 to 10(5) picosecond. Maximum pulse energy is 0.4 J at 1.06 microns in 4 nsec. First measurements on new optical polymers show them to be promising as stable room-temperature nonlinear optical materials.

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1. Objectives of the Research Effort

1. To establish a flexible laboratory source of optical pulses of a variety of pulse lengths, wavelengths and energies.
2. To employ this facility in studies of nonlinear optical materials, and of fast phase conjugation and optical processing.

The pulse lengths will range from 10 psec to 100 nsec, the latter being uncommonly long to the state of the art. Pulse wavelengths will be 1.06 microns, 532 nm, 354 nm, 263 nm, and tunable in the ranges covered by dye lasers pumped at these wavelengths. Pulse energies will range up to 400 mJ Q–switched at 1.06 microns.

For the picosecond studies, the nonlinear optical materials of most immediate interest are photorefractive crystals (e.g., barium titanate and bismuth silicon oxide) and organic polymers, of the polyacetylene family, which have high optical nonlinearity.

The first objective for employment of the "long pulse" capability will be to make the first measurements of phase–conjugation by stimulated Brillouin scattering (SBS) in the steady state regime. (Previous phase–conjugation measurements in SBS have been transient.)

2. Status of This Research Effort

All major components of the purchased equipment were received before the end of the contract period. The "seeding system" which makes long pulse operation

and transform–limited pulses possible was received on 9/28/87. The frequency quadrupler was received on 3/7/87, and the remainder of the equipment outlined in the proposal was received on 1/9/87. Only the long–pulse capability is not yet operational, not surprising considering the advanced concept which is still being perfected in order to make this the first commercially available laser with such a long, high power, narrowband single–mode optical pulse.

With the picosecond pulse capability we have completed the first optical measurements on several of a new class of polymer developed by Dr. L. Dalton and co–workers at the University of Southern California under AFOSR support. These polymers are stable in air and at room temperature and still have a high optical nonlinearity comparable to unstable polyacetylene. Our first results have been accepted for presentation at the forthcoming 1988 Conference on Lasers and Electrooptics (see next section). New measurements are proceeding and show the new polymers to be very promising as optical materials of high nonlinearity and statilibty at room temperature.

3. Papers, Publications, and Interactions supported by This Project

"Picosecond nonlinear optical response of polymeric disubstituted ethylaminovinyl–polyaniline (pDEAVPA)," D.F. Bloch, X.F. Cao, R.W. Hellwarth and J.P.Jiang, paper WW2 at the 1988 Conference on Lasers and Electrooptics, 27 April, 1988 at Anaheim, California. Abstract in Conference Bulletin.

4. **List of Professional Personnel Associated with the Research Effort**

Professor Robert W. Hellwarth

Professor Jack Feinberg

Dr. Humberto Figueroa

Dr. Jouni Partanen

5. No degrees awarded yet from research with this equipment.

6. No patents applied for associated with this project.